RAPID BIOASSESSMENT OF THE

LITTLE PIPE CREEK WATERSHED

USING BENTHIC MACROINVERTEBRATES

October 1995

for the Soil and Water Conservation District of
Miami County, Indiana

Study Conducted By:

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INTRODUCTION

This study was conducted to measure the "biological integrity" of Little Pipe Creek in Miami County, Indiana. Little Pipe Creek has been identified by the Soil and Water Conservation District of Miami County as a small watershed potentially affected by agricultural runoff. This stream is a tributary of the Upper Wabash River, which is listed by the Indiana Department of Environmental Management (IDEM) has as having seriously degraded water quality due to nonpoint sources of pollution [1]. Soil conservation plans are being designed by the Miami County SWCD office to help reduce non-point source problems in the stream. By conducting studies of the biological community of Little Pipe Creek before and after application of land treatments in the watersheds, the study can help determine whether treatments resulted in improved water quality as reflected by an improved aquatic biological community.

Local Setting

Little Pipe Creek is located in the "Eastern Corn Belt Plain" ecoregion of the Central U.S. [2]. The area is a glacial till plain (it was one of the ~~last~~ areas in Indiana to be occupied by glacial ice) and lies in what is sometimes called the "Bluffton Till Plain" Natural Region of Indiana [13] This is an area with little geographic relief and whose soils are typically rich in clay. Much of the area is poorly drained. The original forests were dominated by beech and maple, but row crop agriculture and livestock grazing are the most common land uses today.

At its juncture with the Wabash River, Little Pipe Creek is a "second order" stream with a total watershed area of about 55 square kilometers. Much of the stream in the upper watershed is artificially channelized but the lower areas retain their natural channel characteristics. Only about 5% of the watershed is wooded, with most of the remainder being used for agricultural purposes.

Three "study" sites and a "reference" site were chosen for study (Fig. 1). The study sites represented the upper, middle, and lower parts of the Little Pipe Creek watershed. A summary of each site and its watershed area is shown below:

Site 1	Twelve Mile Creek at CR 450 N (Reference Site)	115 km^2
Site 2	Little Pipe Creek @ CR 500 S (upper)	20 km^2
Site 3	L. Pipe Creek @ Strawtown Pike (middle)	40 km^2
Site 4	L. Pipe Creek at River Road (lower)	55 km^2

All samples and water quality measurements reported here were collected on October 23, 1995.

Figure 1.

Generalized location of all sites.

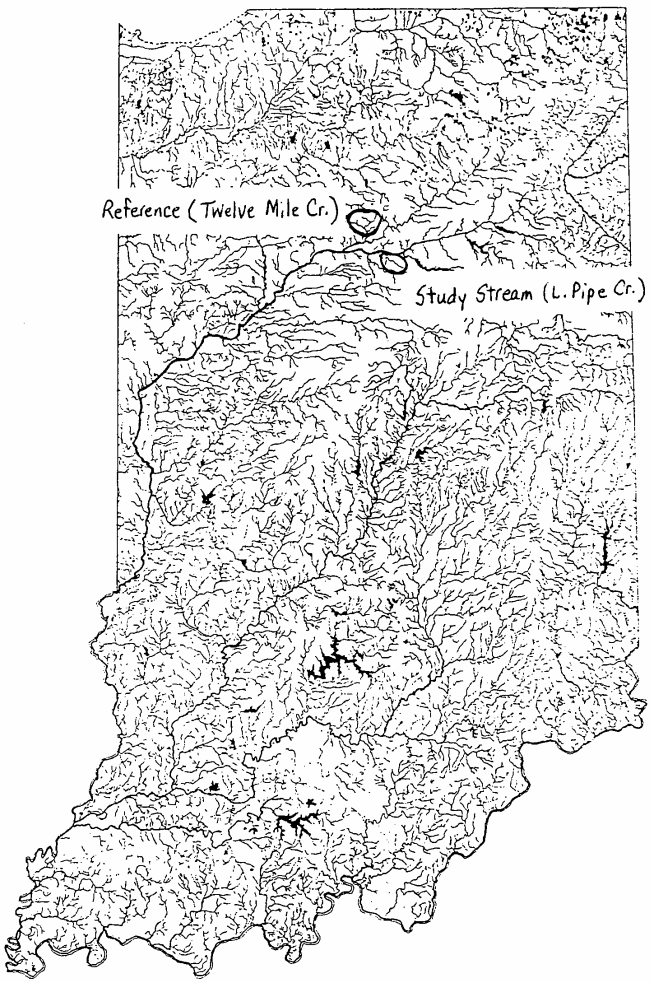
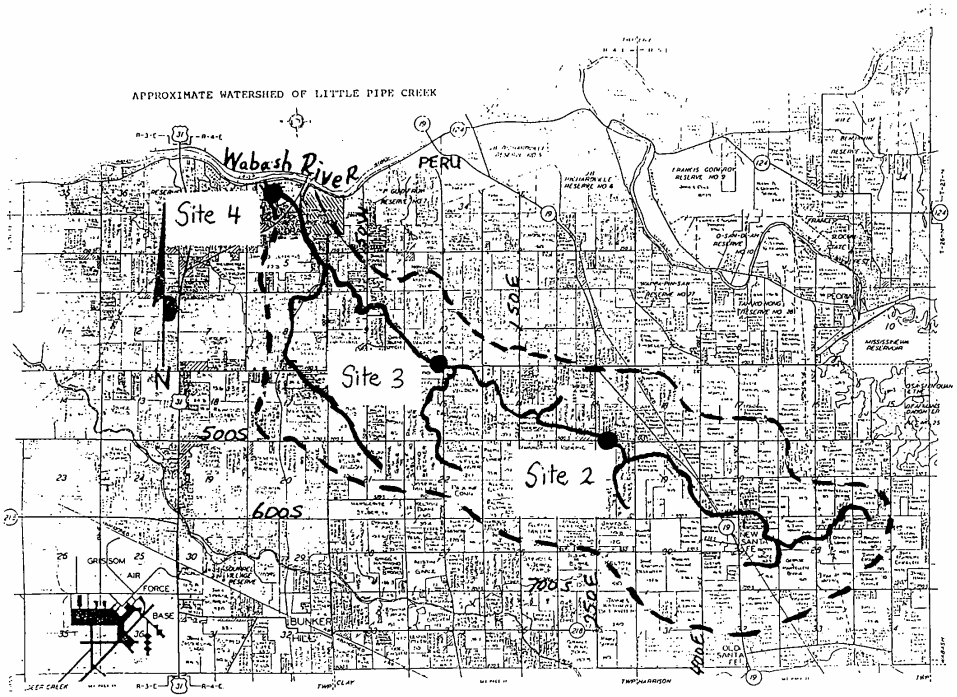


Figure 2.

Locations of study sites on Little Pipe Creek.



METHODS

Because they are considered to be more sensitive to local conditions and respond relatively rapidly to environmental change [3], benthic (bottom-dwelling) organisms were used to document the biological condition of Little Pipe Creek. The U.S. Environmental Protection Agency (EPA) has recently developed a "rapid bioassessment" protocol [4] which has been shown to produce highly reproducible results that accurately reflect changes in water quality. We used EPA's Protocol III to conduct this study. Protocol III requires a standardized collection technique, a standardized subsampling technique, and identification of at least 100 animals from each site to the genus or species level from both "study sites" and a "reference site."

Reference Site

The aquatic community of a reference site is compared to that of each study site to determine how much impact has occurred. The reference site should be in the same "ecoregion" as the study sites and be approximately the same size. It should be as pristine as possible, representing the best conditions possible for that area. Twelve Mile Creek in Cass County was chosen as the reference site for this study. Its watershed area is about 115 square kilometers, which is not much larger than those of most study sites on Little Pipe Creek. In addition, it is located only a few kilometers north of the Little Pipe Creek watershed, and therefore is representative of local conditions. Twelve Mile Creek is known to have excellent aquatic habitat and one of the highest "biotic index values" for fish communities of all local tributaries [5]. Therefore, its habitat and water quality are probably among the best available within this area.

115 km² vs. 55 km²? are both 2nd order?

Sample Collection

Samples in this study were collected by kicknet from riffle habitat where current speed was 20-30 cm/sec. Riffles were used because they were the most important benthic habitat present at all study sites. The kicknet was placed immediately downstream from the riffle while the sampler used a hand to dislodge all attached benthic organisms from rocks upstream from the net. The organisms were swept by the current into the kicknet and subsequently transferred to a white pan. Each sample was examined in the field to assure that at least 100 organisms were collected at each site. In addition, each site was sampled for organisms in CPOM (coarse particulate organic matter, usually consisting of leaf packs from fast-current areas). All samples were preserved in the field with 70% ethanol.

Laboratory Analysis

In the laboratory, a 100 organism subsample was prepared from each site by evenly distributing the whole sample in a white, gridded pan. Grids were randomly selected and all organisms within grids were removed until 100 organisms had been selected from the entire sample.

Each animal was identified to the lowest practical taxon (usually genus or species). As each new taxon was identified. a representative specimen was preserved as a "voucher." All voucher specimens will ultimately be deposited in the Purdue University Department of Entomology collection.

Quality Assurance

To help assure the quality of the results, a duplicate sample was collected at site 4. The biological scores of each sample were measured to determine the amount of variability associated with the technique. Ideally, the individual scores of duplicate samples should be within about 10% of the mean score to assure that reproducible results are obtained.

RESULTS

Quality Assurance

The biotic index scores of site 4, as determined by duplicate samples, were within 10% of the mean (see Appendix). The use impairment categories determined by both samples were identical. These indicators show that the bioassessment technique resulted in reproducible and reliable data during this study period.

Aquatic Habitat Analysis

When the Ohio EPA habitat scoring technique was used, the following aquatic habitat values were obtained for each site in the study:

	Score	% of Reference
Twelve Mile Creek (reference, Site 1)	76	100
Upper Little Pipe Creek (Site 2)	51	67
Middle L. Pipe Creek (Site 3)	56	74
Lower L. Pipe Creek (Site 4)	68	89

The maximum value obtainable by this scoring technique is 100, with higher values indicating better habitat. Sites with lower habitat values normally have lower biotic index values as well.

The scores indicate that the lowest habitat value in this study was at Site 2 (Upper Little Pipe Creek near CR 500 S). Habitat at Site 2 was hampered by a paucity of stable bottom substrate and instream cover, by the narrowness of its riparian buffer zone, and by little water flow. Sediment deposition appeared to be heavier at this site than elsewhere in the watershed. Habitat value of Little Pipe Creek increased in a downstream direction, and attained a score that was within 89% of the reference site by the time the stream joined the Wabash River.

Water Quality Measurements
October 23, 1995

	D.O. mg/l	pH SU	Cond. uS	Temp. (F)
Reference Site 1 Time = 5:30 p.m.	12.0	7.5	600	57
Site 2 Time = 3:30 p.m.	8.9	7.4	600	57
Site 3 Time = 2:10 p.m.	9.0	7.4	500	56
Site 4 Time = 12:50 p.m.	8.8	7.2	550	52

D.O. = Dissolved Oxygen
Cond. = Conductivity
Temp. = Temperature in Degrees Fahrenheit

Mussel Observations

No mussel shells or live mussels were observed at any of the three study sites on Little Pipe Creek. There is no historical record of the presence of mussels within this stream.

Table 1.
Rapid Bioassessment Results - Little Pipe Creek - October 1995

	Site # 1	2	3	4
Chironomidae (Midges)				
Dicrotendipes sp.		13		
Orthocladius obumbratus	18		15	41
Diplocladius sp.	1			6
Euorthocladius sp.	1		1	2
Thienemanniella sp.	1			
Microtendipes caelum	1	1		2
Thienemannymia gr.	1	13	5	
Empididae (Dance Flies)				2
Tabanidae (Horseflies)		1		
Tipulidae (Craneflies)				
Tipula sp.		1	1	
Antocha sp.				1
Ephemeroptera (Mayflies)				
Stenonema vicarium	15			
S. femoratum			1	1
Stenacron interpunctatum				19
Tricorythodes sp.	1			
Isonychia sayi	4			
Trichoptera (Caddisflies)				
Cheumatopsyche spp.	25	18	44	8
Hydropsyche betteni		5	5	
Ceratopsyche sparna				1
C. bifida	5			1
C. slossonae	1			
Chimarra obscura			1	
Pycnopsyche sp.	1			
Coleoptera (Beetles)				
Macronychus glabratus	4			
Stenelmis crenata	17	14	24	2
Dubiraphia vittata			1	
Optioservus sp.	1	24		
Psephenus herricki	2		1	
Peltodytes sp.		1		

Table 1 (cont.)
Rapid Bioassessment Results - Little Pipe Creek - October 1995

	Site # 1	2	3	4
Odonata (Dragonflies)				
Calopteryx sp.			1	
Isopoda (Sowbugs)				
Caecidotea sp.				14
Gastropoda (Snails)				
Physella sp.		1		
Ferrissia sp.	1			
Pelecypoda (Clams)				
Sphaerium stiatinum		3		
Oligochaeta (Worms)				
Tubificidae		5		
Total	100	100	100	100

Table 2. Data Analysis for 10/95 Samples

METRICS

	Site # 1	2	3	4
# of Genera	17	13	12	12
Biotic Index	5.2	6.8	6.5	7.5
Scrapers/Filterers	1.0	0.6	0.5	2.2
EPT/Chironomids	2.3	0.8	2.4	0.6
% Dominant Taxon	25	24	44	37
EPT Index	6	2	4	4
Community Loss Index	0.0	0.9	0.8	0.7
% Shredders (CPOM)	1	4	1	10

SCORING

	Site # 1	2	3	4
# of Genera	6	4	4	4
Biotic Index	6	4	4	4
Scrapers/Filterers	6	6	6	6
EPT/Chironomids	6	2	6	2
% Dominant Taxon	4	4	0	2
EPT Index	6	0	2	2
Community Loss Index	6	4	4	4
% Shredders (CPOM)	6	6	6	6
TOTAL	46	30	32	30
% of Reference	100	65	70	65
Impairment Category	N	S	S	S

N = NONE S = SLIGHT M = MODERATE

DISCUSSION

Chemical parameters measured at each site indicate that dissolved oxygen, pH, temperature, and conductivity fell within acceptable ranges for most forms of aquatic life.

A total of 34 macroinvertebrate genera were collected at the four sites. The most commonly collected invertebrates were caddisfly larvae (Cheumatopsyche sp. at Sites 1 and 3), midge larvae (e.g. Orthocladius at Site 4) or riffle beetles (e.g. Optioservus at Site 2).

Figure 2 shows the normal relationship of biotic index scores to habitat values (a linear relationship according to [4]). The figure also shows a range of plus or minus 10% to account for a certain amount of measurement variability. When biotic index values fall outside this range, the site typically has degraded water quality. Figure 2 indicates that Sites 2 and 3 had biotic values well within the range expected from their measured habitat values. Therefore, these sites were probably affected primarily by degraded habitat. However, Site 4 had a biotic index value well below that predicted by its habitat. This site was probably affected by degraded water quality.

An examination of those metrics showing the greatest difference from the reference stream may provide an important clue about causes of biological impairment at Site 4. The largest differences at this site occurred in the EPT/Chironomid ratio and the EPT index value. The decline of number and types of EPT organisms and a concurrent rise in chironomid abundance is associated with several kinds of environmental degradation. For example, several studies have shown this metric to be associated with instream toxicity [10]. However, changes in other metrics commonly indicating toxicity problems (e.g. a reduction in the number of taxa) were not observed and few "toxic indicator" organisms were observed at any site. A more likely explanation for this shift in the types of animals present is stress caused by stream sedimentation or nutrient enrichment, often associated with agricultural runoff. Such changes favoring chironomids at the expense of EPT taxa have been observed in other studies [8].

Figure 3.
Habitat vs. Biotic Index Scores

Sites falling outside the +10% range are probably affected by degraded water quality

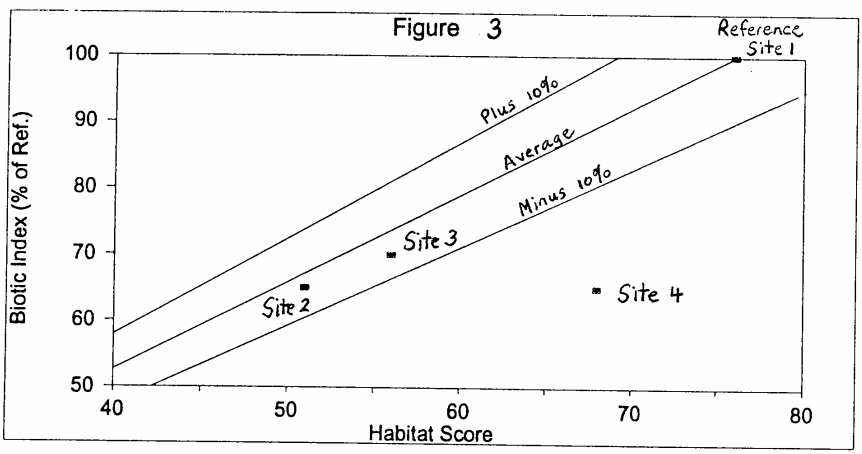


Table 4 shows sediment-tolerance values for many of the commonly collected animals in these streams. Sediment and turbidity-tolerant forms were abundant at all sites, including the reference site. The relative abundance of sediment-tolerant forms was considerably higher than the reference, especially at Sites 3 and 4. In addition, the number of sediment-intolerant organisms was much lower at all three Little Pipe Creek sites than in the reference stream. These results support the conclusion that excessive sedimentation is impairing the biological communities of at least some of the sites on Little Pipe Creek.

It is interesting to note that the Hilsenhoff Biotic Index (HBI) metric, which is highly sensitive to reductions in dissolved oxygen [16], was also higher at Site 4 than at either of the other two study sites. This may indicate that, in addition to sedimentation, a significant source of oxygen-demanding pollutants is also contributing to the water quality degradation observed at Site 4. Measured D.O. at Site 4 was well within acceptable concentrations, but D.O. at the site could be much lower on occasion. a(all summary?)

cold water = Oct

Site 4 is downstream from a major tributary draining the westernmost quandrant of the Little Pipe Creek watershed. It is possible that inputs from this tributary may be contributing to the lower water quality at Site 4.

Comparison to Other Studies

There are no previously published studies of the fish or benthic macroinvertebrate communities of Little Pipe Creek.

DAMNED SCIENTISTS & THEIR SMARTY-PANTS METRIC SYSTEM! ACTUALLY, NOT A BIG DEAL WITH ME, BUT IT WOULD BE NICE TO HAVE ENGLISH UNITS TOO.

IT WOULD BE NICE TO INCLUDE EXPLANATIONS OF ACRONYMS LIKE "EPT" & "CPOM", AS WELL AS TERMS LIKE "SHREDDER", FOR THE NON-SCIENTIST READER. (WE DON'T WANT THEM THINKING THAT A TEENAGE MUTANT NINJA TURTLE CHARACTER IS INVOLVED.)

I AGREE WITH YOU ON THE POINT ABOUT DO./TEMPERATURE. THAT SHOULD BE EXPLAINED A LITTLE MORE. ↖ Jim Ray's comments

Table 4. Sediment-Tolerant Species Observed
(References shown in brackets)

Cheumatopsyche sp.	[8] [9]
Hydropsyche betteni	[8]
Tricorythodes sp.	[9] [11] [12]
Stenacron interpunctatum	[9]
Orthocladius spp.	[9] [15]
Thienemannymia group	[9]
Calopteryx sp.	[9]
Macronychus glabratus	[9]
Tubificidae	[11]

October Samples

% of Sediment-Tolerant Organisms at the Reference Site 1	49%
% of Sediment-Tolerant Organisms at the Study Sites	
Site 2	41%
Site 3	69%
Site 4	64%

Sediment-Intolerant Species Observed

Microtendipes sp.	[6] [9]
Tipula sp.	[9]
Antocha sp.	[9]
Ceratopsyche sp.	[7]
Chimarra obscura	[9]
Limnelphilidae	[9]
Stenonema vicarium	[9] [14]
S. tripunctatum	[9] [14]

October Samples

% of Sediment-Intolerant Organisms at the Reference Site 1	23%
% of Sediment-Intolerant Organisms at the Study Sites	
Site 2	2%
Site 3	3%
Site 4	6%

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Site 4 is downstream from a major tributary draining the westernmost quandrant of the Little Pipe Creek watershed. It is possible that inputs from this tributary may be contributing to the lower water quality at Site 4.

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S. tripunctatum	[9] [14]

October Samples

% of Sediment-Intolerant Organisms at the Reference Site 1	23%
% of Sediment-Intolerant Organisms at the Study Sites	
Site 2	2%
Site 3	3%
Site 4	6%

RECOMMENDATIONS

1. Continue to monitor these sites during 1996 to provide additional baseline information on the watershed prior to start-up of land treatments.

2. Work toward continued protection of the vegetative buffer zone along the stream corridor. The lower stream presently has a good vegetative buffer, but much of headwaters has little or no protective vegetation along the stream banks.

3. Discourage channelization of Little Pipe Creek. Only the most extreme headwaters have been recently channelized, allowing the lower parts of the stream to retain a natural channel that enhances aquatic habitat.

4. Discourage direct access to the stream by livestock. Large numbers of livestock can trample stream banks, decreasing the ability of streamside vegetation to filter out pollutants and hastening erosion.

5. Use bioassessment to monitor the unnamed tributary draining the westernmost quadrant of the watershed. This should help determine whether the tributary is contributing to observed water quality problems at Site 4.

6. Evaluate land use to identify significant contributors of nonpoint source pollutants such as livestock waste and eroded soil.

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Metric Values
Little Pipe Creek Site 4, Miami Co.

Sample 1 collected by Greg R. Bright
Sample 2 collected by Jan Stout
Samples collected 10/23/95

	Sample 1	Sample 2
Total Genera	12	13
EPT Genera	4	5
Scrapers/Filterers	2.2	0.3
% Dominant Taxon	37	36
EPT/Chironomids	0.6	0.8
Community Loss Index	0.75	0.69
Hilsenhoff Biotic Index	7.5	7.1
% Shredders	10	1

Site Scores in Relation to the Reference (Site 1)

	Sample 1	Sample 2
Total Genera	4	4
EPT Genera	2	4
Scrapers/Filterers	6	2
% Dominant Taxon	2	2
EPT/Chironomids	2	2
Community Loss Index	4	4
Hilsenhoff Biotic Index	4	4
% Shredders	6	6
	30	28

Mean Site Score = 29
Each duplicate is within 10% of the mean
Both scores indicate "slight impact"

Procedure No. WQMA-SWS-3 Date Issued 10/1/87
Revision No. 5 * Effective 10/1/87

Figure V-4-1. Front side of the Ohio EPA Site Description Sheet for evaluating the geographical and physical characteristics of fish sampling locations. This is used to record information for the calculation of the Qualitative Habitat Evaluation Index (QHEI). Twelve Mile – Site 1

Ohio EPA Site Description Sheet - Fish

Stream _____ RM _____ Date _____ River Code _____
Location _____ USGS Quad _____
Township _____ Section _____ Latit./Longit. _____ / _____
Crew: _____ County _____

76 TOTAL QHEI

1] SUBSTRATE (Check ONLY Two Substrate TYPES); % POOL/RIFFLE SUBSTRATES OPTIONAL

TYPE	POOL	RIFFLE
☐ D-BOULDER [7]	___	___
☒ C-COBBLE [6]	___	___
☐ D-HARDPAN [3]	___	___
☐ D-SILT [3]	___	___
☐ D-MUCK [2]	___	___
☒ G-GRAVEL [5]	___	___
☐ D-SAND [4]	___	___
☐ D-BEDROCK[3]	___	___
☐ D-DETRITUS[2]	___	___
☐ D-SLUDGE[1]	___	___

QUALITY — Check ALL That Apply:
☐ D-SILT COVERED [-1]
☒ S-SILT FREE [1]
☐ D-BOULDERS AS SLABS [1]
☐ D-EMBEDDED [-2]

12 SUBSTRATE

COMMENTS: _____

2] INSTREAM COVER

TYPE (Check ALL That Apply)
☐ - UNDERCUT BANKS [1]
☒ - OVERHANGING VEGETATION [1]
☐ - SHALLOWS (IN SLOW WATER) [1]
☒ - LOGS OR WOODY DEBRIS [1]
☐ - DEEP POOLS [1]
☐ - OXBOWS [1]
☒ - BOULDERS [1]
☐ - AQUATIC MACROPHYTES [1]

AMOUNT (Check ONLY One)
☐ - EXTENSIVE [7]
☒ - MODERATE [3]
☐ - SPARSE [3]
☐ - NEARLY ABSENT [1]

8 COVER

COMMENTS: _____

3] CHANNEL MORPHOLOGY: (Check ONLY One Under Each Category)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	OTHER
☐ - HIGH [4]	☐ - EXCELLENT [4]	☒ - NONE [4]	☒ - HIGH [3]	☐ - IMPOUND.
☒ - MODERATE [3]	☒ - GOOD [3]	☐ - RECOVERED [3]	☐ - MODERATE [2]	☐ - ISLANDS
☐ - LOW [2]	☐ - FAIR [2]	☐ - RECOVERING [2]	☐ - LOW [1]	☐ - LEVEED
☐ - NONE [1]	☐ - POOR [1]	☐ - RECENT OR NO RECOVERY [1]		

13 CHANNEL

COMMENTS: _____

4] RIPARIAN ZONE AND BANK EROSION *River Right Looking Downstream*

RIPARIAN WIDTH L R (Per Bank)	FLOOD PLAIN QUALITY (Check 2 Most Predominant)	BANK EROSION L R (Per Bank)
☐ ☐ D-EXTENSIVE >100m [5]	☐ ☒ F-FOREST, SWAMP [3]	☐ ☐ D-NONE [5]
☐ ☒ E-WIDE 50-100m [4]	☐ ☐ D-OPEN PASTURE [1]	☐ ☒ E-LITTLE [4]
☐ ☐ D-MODERATE 10-50m [3]	☐ ☐ D-OLD FIELD [3]	☐ ☐ D-MODER.[3]
☐ ☐ D-NARROW 5-10m [2]	☐ ☐ D-RESIDENTIAL PARK [2]	☐ ☐ D-HEAVY [2]
☐ ☐ D-VERY NARROW 1-5m [1]	☐ ☐ D-CONSERV. TILLAGE [2]	☐ ☐ D-SEVERE [1]
☐ ☐ D-NONE [0]	☐ ☐ D-FENCED PASTURE [2]	
	☐ ☒ C-ROWCROP [1]	
	☐ ☐ D-SHRUB [4]	

14 RIPARIAN

COMMENTS: _____

5] POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1)	POOL COVER (Check 1)	OVERALL CURRENT VELOCITY (Check ALL That Apply)	MORPHOLOGY (Check 1)
☐ - >1m [3]	☐ D-EXTENSIVE [3]	☐ D-TORRENTIAL[-1] ☐ D-EDDIES [1]	☒ P-POOL WIDTH > RIFFLE WIDTH [2]
☒ - 0.7-1m [2]	☒ - MODERATE [2]	☒ - FAST [1] ☐ D-INTERSTITIAL[-1]	☐ D-POOL WIDTH = RIFFLE WIDTH [1]
☐ D- 0.4-0.7m [1]	☐ D-SPARSE [1]	☒ - MODERATE [1]	☐ D-POOL WIDTH < RIFFLE W. [0]
☐ D- <0.4m [0]	☐ D-NEARLY ABSENT [0]	☒ - SLOW [1]	
		☐ D-INTERMITTENT[-2]	

13 POOL/RIFFLE

☐ D-NO POOL[0] COMMENTS: _____

RIFFLE/RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN SUBSTRATE QUALITY
☐ - GENERALLY <10 cm [1]	☒ - STABLE (Cobble, Boulder) [1]	☐ - EMBEDDED [0]
☒ - GENERALLY >10 cm, MAX<50 [2]	☐ - UNSTABLE (Gravel, Sand) [0]	☒ - NOT EMBED. [1]
☐ - GENERALLY >10 cm, MAX>50 [3]		6] Gradient (ft/mi): 25
☐ - NO RIFFLE[0]		7] Drainage area (sq.mi.): 45

6 GRADIENT

10 DRAINAGE AREA

Procedure No. WQMA-SWS-3 Date Issued 10/1/87
Revision No. 5 * Effective 10/1/87

Figure V-4-1. Front side of the Ohio EPA Site Description Sheet for evaluating the geographical and physical characteristics of fish sampling locations. This is used to record information for the calculation of the Qualitative Habitat Evaluation Index (QHEI).

CR 500 S - Site 2

Ohio EPA Site Description Sheet - Fish

Stream RM Date River Code
Location USGS Quad
Township Section Latit./Longit. /
Crew: County

51 TOTAL QHEI

1] SUBSTRATE (Check ONLY Two Substrate TYPES); % POOL/RIFFLE SUBSTRATES OPTIONAL

TYPE	POOL	RIFFLE	TYPE	POOL	RIFFLE	QUALITY
☐ BOULDER [7]			☐ GRAVEL [5]		✓	Check ALL That Apply:
☐ COBBLE [6]			☐ SAND [4]		✓	☐ SILT COVERED [-1]
☐ HARDPAN [3]			☐ BEDROCK[3]			☐ SILT FREE [1]
☐ SILT [3]			☐ DETRITUS[2]			☐ BOULDERS AS SLABS [1]
☐ MUCK [2]			☐ SLUDGE[1]			☐ EMBEDDED [-2]

8 SUBSTRATE

COMMENTS

2] INSTREAM COVER

TYPE (Check ALL That Apply)		AMOUNT (Check ONLY One)
☐ UNDERCUT BANKS [1]	☐ DEEP POOLS [1]	☐ EXTENSIVE [7]
☒ OVERHANGING VEGETATION [1]	☐ OXBOWS [1]	☐ MODERATE [5]
☐ SHALLOWS (IN SLOW WATER) [1]	☐ BOULDERS [1]	☒ SPARSE [3]
☒ LOGS OR WOODY DEBRIS [1]	☐ AQUATIC MACROPHYTES [1]	☐ NEARLY ABSENT [1]

5 COVER

COMMENTS:

3] CHANNEL MORPHOLOGY: (Check ONLY One Under Each Category)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	OTHER
☐ HIGH [4]	☐ EXCELLENT [4]	☐ NONE [4]	☐ HIGH [3]	☐ IMPOUND.
☒ MODERATE [3]	☐ GOOD [3]	☒ RECOVERED [3]	☒ MODERATE [2]	☐ ISLANDS
☐ LOW [2]	☒ FAIR [2]	☐ RECOVERING [2]	☐ LOW [1]	☐ LEVEED
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]		

10 CHANNEL

COMMENTS:

4] RIPARIAN ZONE AND BANK EROSION *River Right Looking Downstream*

RIPARIAN WIDTH L R (Per Bank)	FLOOD PLAIN QUALITY (Check 2 Most Predominant)		BANK EROSION L R (Per Bank)
☐ ☐ EXTENSIVE >100m [5]	☐ FOREST, SWAMP [5]	☐ URBAN [1]	☐ ☐ NONE [5]
☐ ☐ WIDE 50-100m [4]	☐ OPEN PASTURE [1]	☒ ☐ ROWCROP [1]	☐ ☐ LITTLE [4]
☐ ☐ MODERATE 10-50m [3]	☐ OLD FIELD [3]	☐ SHRUB [4]	☒ ☐ MODER. [3]
☐ ☒ NARROW 5-10m [2]	☐ RESIDENTIAL, PARK [2]		☐ ☐ HEAVY [2]
☐ ☐ VERY NARROW 1-5m [1]	☐ CONSERV. TILLAGE [2]		☐ ☐ SEVERE [1]
☐ ☐ NONE [0]	☐ FENCED PASTURE [2]		

7 RIPARIAN

COMMENTS:

5] POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1)	POOL COVER (Check 1)	OVERALL CURRENT VELOCITY (Check ALL That Apply)		MORPHOLOGY (Check 1)
☐ >1m [3]	☐ EXTENSIVE [3]	☐ TORRENTIAL[-1]	☐ EDDIES[1]	☒ POOL WIDTH > RIFFLE WIDTH [2]
☐ 0.7-1m [2]	☐ MODERATE [2]	☐ FAST[1]	☐ INTERSTITIAL[-1]	
☒ 0.4-0.7m [1]	☒ SPARSE [1]	☐ MODERATE [1]		☐ POOL WIDTH = RIFFLE WIDTH [1]
☐ <0.4m [0]	☐ NEARLY ABSENT [0]	☒ SLOW [1]		☐ POOL WIDTH < RIFFLE W. [0]
		☐ INTERMITTENT[-2]		

6 POOL/RIFFLE

☐ NO POOL[0] COMMENTS:

RIFFLE/RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN SUBSTRATE QUALITY
☒ GENERALLY <10 cm [1]	☐ STABLE (Cobble, Boulder) [1]	☒ EMBEDDED [0]
☐ GENERALLY >10 cm, MAX<50 [2]	☒ UNSTABLE (Gravel, Sand) [0]	☐ NOT EMBED. [1]
☐ GENERALLY >10 cm, MAX>50 [3]		6] Gradient (ft/mi): 15
☐ NO RIFFLE[0]		7] Drainage area (sq.mi.): 10

8 GRADIENT 7 DRAINAGE AREA

Procedure No. WQMA-SWS-3 Date Issued 10/1/87
Revision No. 5 * Effective 10/1/87

Figure V-4-1. Front side of the Ohio EPA Site Description Sheet for evaluating the geographical and physical characteristics of fish sampling locations. This is used to record information for the calculation of the Qualitative Habitat Evaluation Index (QHEI). Strawtown Rd - Site 3

Ohio EPA Site Description Sheet - Fish

Stream RM Date River Code
Location USGS Quad
Township Section Latit./Longit. /
Crew: County

56 TOTAL QHEI

1] SUBSTRATE (Check ONLY Two Substrate TYPES); % POOL/RIFFLE SUBSTRATES OPTIONAL

TYPE	POOL	RIFFLE
☐ BOULDER [7]		☐ GRAVEL [5]
☐ COBBLE [6]		☐ SAND [4]
☐ HARDPAN [3]		☐ BEDROCK [3]
☐ SILT [3]		☐ DETRITUS [2]
☐ MUCK [2]		☐ SLUDGE [1]

QUALITY (Check ALL That Apply):
☐ SILT COVERED [-1]
☐ SILT FREE [1]
☐ BOULDERS AS SLABS [1]
☐ EMBEDDED [-2]

8 SUBSTRATE

COMMENTS:

2] INSTREAM COVER

TYPE (Check ALL That Apply)	AMOUNT (Check ONLY One)
☐ UNDERCUT BANKS [1]	☐ DEEP POOLS [1]	☐ EXTENSIVE [7]
☐ OVERHANGING VEGETATION [1]	☐ OXBOWS [1]	☐ MODERATE [5]
☐ SHALLOWS (IN SLOW WATER) [1]	☐ BOULDERS [1]	☐ SPARSE [3]
☐ LOGS OR WOODY DEBRIS [1]	☐ AQUATIC MACROPHYTES [1]	☐ NEARLY ABSENT [1]

6 COVER

COMMENTS:

3] CHANNEL MORPHOLOGY: (Check ONLY One Under Each Category)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	OTHER
☐ HIGH [4]	☐ EXCELLENT [4]	☐ NONE [4]	☐ HIGH [3]	☐ IMPOUND.
☐ MODERATE [3]	☐ GOOD [3]	☐ RECOVERED [3]	☐ MODERATE [2]	☐ ISLANDS
☐ LOW [2]	☐ FAIR [2]	☐ RECOVERING [2]	☐ LOW [1]	☐ LEVEED
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]		

10 CHANNEL

COMMENTS:

4] RIPARIAN ZONE AND BANK EROSION *River Right Looking Downstream*

RIPARIAN WIDTH L R (Per Bank)	FLOOD PLAIN QUALITY (Check 2 Most Predominant)	BANK EROSION L R (Per Bank)
☐ ☐ EXTENSIVE >100m [5]	☐ FOREST, SWAMP [5] ☐ URBAN [1]	☐ NONE [5]
☐ ☐ WIDE 50-100m [4]	☐ OPEN PASTURE [1] ☐ ROWCROP [1]	☐ LITTLE [4]
☐ ☐ MODERATE 10-50m [3]	☐ OLD FIELD [3] ☐ SHRUB [4]	☐ MODER. [3]
☐ ☐ NARROW 5-10m [2]	☐ RESIDENTIAL, PARK [2]	☐ HEAVY [2]
☐ ☐ VERY NARROW 1-5m [1]	☐ CONSERV. TILLAGE [2]	☐ SEVERE [1]
☐ ☐ NONE [0]	☐ FENCED PASTURE [2]	

9 RIPARIAN

COMMENTS:

5] POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1)	POOL COVER (Check 1)	OVERALL CURRENT VELOCITY (Check ALL That Apply)	MORPHOLOGY (Check 1)
☐ >1m [3]	☐ EXTENSIVE [3]	☐ TORRENTIAL [-1] ☐ EDDIES [1]	☐ POOL WIDTH > RIFFLE WIDTH [2]
☐ 0.7-1m [2]	☐ MODERATE [2]	☐ FAST [1] ☐ INTERSTITIAL [-1]	☐ POOL WIDTH = RIFFLE WIDTH [1]
☐ 0.4-0.7m [1]	☐ SPARSE [1]	☐ MODERATE [1]	☐ POOL WIDTH < RIFFLE W. [0]
☐ <0.4m [0]	☐ NEARLY ABSENT [0]	☐ SLOW [1] ☐ INTERMITTENT [-2]	

7b POOL/RIFFLE

☐ NO POOL [0] COMMENTS:

RIFFLE/RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN SUBSTRATE QUALITY
☐ GENERALLY <10 cm [1]	☐ STABLE (Cobble, Boulder) [1]	☐ EMBEDDED [0]
☐ GENERALLY >10 cm, MAX<50 [2]	☐ UNSTABLE (Gravel, Sand) [0]	☐ NOT EMBED. [1]
☐ GENERALLY >10 cm, MAX>50 [3]		6] Gradient (ft/mi): 15
☐ NO RIFFLE [0]		7] Drainage area (sq.mi.): 15

8 GRADIENT

8 DRAINAGE AREA

Procedure No. WQMA-SWS-3 Date Issued 10/1/87
Revision No. 5 * Effective 10/1/87

Figure V-4-1. Front side of the Ohio EPA Site Description Sheet for evaluating the geographical and physical characteristics of fish sampling locations. This is used to record information for the calculation of the Qualitative Habitat Evaluation Index (QHEI).

Site 4

Ohio EPA Site Description Sheet - Fish

Stream _____ RM _____ Date _____ River Code _____
Location _____ USGS Quad _____
Township _____ Section _____ Latit./Longit. _____ / _____
Crew: _____ County _____

TOTAL QHEI: 68

1] SUBSTRATE (Check ONLY Two Substrate TYPES); % POOL/RIFFLE SUBSTRATES OPTIONAL

TYPE	POOL	RIFFLE	TYPE	POOL	RIFFLE
☐ BOULDER [7]	___	___	☐ GRAVEL [3]	___	✓
☐ COBBLE [6]	___	✓	☐ SAND [4]	___	___
☐ HARDPAN [3]	___	___	☐ BEDROCK[3]	___	___
☐ SILT [3]	___	___	☐ DETRITUS[2]	___	___
☐ MUCK [2]	___	___	☐ SLUDGE[1]	___	___

QUALITY (Check ALL That Apply): ☐ SILT COVERED [-1] ☐ SILT FREE [1] ☐ BOULDERS AS SLABS [1] ☐ EMBEDDED [-2]

SUBSTRATE: 12

COMMENTS: _____

2] INSTREAM COVER

TYPE (Check ALL That Apply)		AMOUNT (Check ONLY One)
☐ - UNDERCUT BANKS [1]	☐ - DEEP POOLS [1]	☐ - EXTENSIVE [7]
☒ - OVERHANGING VEGETATION [1]	☐ - RIFFLES [1]	☒ - MODERATE [5]
☐ - SHALLOWS (IN SLOW WATER) [1]	☒ - BOULDERS [1]	☐ - SPARSE [3]
☒ - LOGS OR WOODY DEBRIS [1]	☐ - AQUATIC MACROPHYTES [1]	☐ - NEARLY ABSENT [1]

COVER: 8

COMMENTS: _____

3] CHANNEL MORPHOLOGY: (Check ONLY One Under Each Category)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	OTHER
☐ - HIGH [4]	☐ - EXCELLENT [4]	☒ - NONE [4]	☒ - HIGH [3]	☐ - IMPOUND.
☒ - MODERATE [3]	☒ - GOOD [3]	☐ - RECOVERED [3]	☐ - MODERATE [2]	☐ - ISLANDS
☐ - LOW [2]	☐ - FAIR [2]	☐ - RECOVERING [2]	☐ - LOW [1]	☐ - LEVEED
☐ - NONE [1]	☐ - POOR [1]	☐ - RECENT OR NO RECOVERY [1]		

CHANNEL: 13

COMMENTS: _____

4] RIPARIAN ZONE AND BANK EROSION *River Right Looking Downstream*

RIPARIAN WIDTH L R (Per Bank)	FLOOD PLAIN QUALITY (Check 2 Most Predominant)	BANK EROSION L R (Per Bank)
☐ ☐ - EXTENSIVE >100m [5]	☐ ☐ - FOREST, SWAMP [5]	☐ ☐ - URBAN [1]
☒ ☐ - WIDE 50-100m [4]	☐ ☐ - OPEN PASTURE [1]	☒ ☒ - ROWCROP [1]
☐ ☐ - MODERATE 10-50m [3]	☐ ☐ - OLD FIELD [3]	☐ ☐ - SHRUB [4]
☐ ☐ - NARROW 5-10m [2]	☐ ☐ - RESIDENTIAL/PARK [2]	☐ ☐ - MODER. [3]
☐ ☐ - VERY NARROW 1-5m [1]	☐ ☐ - CONSERV. TILLAGE [2]	☐ ☐ - HEAVY [2]
☐ ☐ - NONE [0]	☐ ☐ - FENCED PASTURE [2]	☐ ☐ - SEVERE [1]

RIPARIAN: 10

COMMENTS: _____

[5] POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1)	POOL COVER (Check 1)	OVERALL CURRENT VELOCITY (Check ALL That Apply)	MORPHOLOGY (Check 1)
☐ - >1m [3]	☐ - EXTENSIVE [3]	☐ - TORRENTIAL[-1] ☐ - EDDIES [1]	☒ - POOL WIDTH > RIFFLE WIDTH [2]
☒ - 0.7-1m [2]	☐ - MODERATE [2]	☐ - FAST[1] ☐ - INTERSTITIAL[-1]	☐ - POOL WIDTH = RIFFLE WIDTH [1]
☐ - 0.4-0.7m [1]	☒ - SPARSE [1]	☐ - MODERATE [1]	☐ - POOL WIDTH < RIFFLE W. [0]
☐ - <0.4m [0]	☐ - NEARLY ABSENT [0]	☒ - SLOW [1]	
		☐ - INTERMITTENT[-2]	

POOL/RIFFLE: 10

☐ - NO POOL[0] COMMENTS: _____

RIFFLE/RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN SUBSTRATE QUALITY
☒ - GENERALLY <10 cm [1]	☒ - STABLE (Cobble, Boulder) [1]	☐ - EMBEDDED [0]
☐ - GENERALLY >10 cm, MAX<50 [2]	☐ - UNSTABLE (Gravel, Sand) [0]	☒ - NOT EMBED. [1]
☐ - GENERALLY >10 cm, MAX>50 [3]		6] Gradient (ft/mi): 25
☐ - NO RIFFLE[0]		7] Drainage area (sq.mi.): 21

GRADIENT: 6
DRAINAGE AREA: 9

Site 4

SUMMARY OF MACROINVERTEBRATE DATA

STATION (LOCATION): Little Pipe Creek @ River Rd.

ORGANISM:	10/23/95 Date									
Stenonema tripunctatum	1									
Stenacron interpunctatum	19									
Cheumatopsyche spp.	8									
Ceratopsyche bifida	1									
C. sparna	1									
Stehelmis larvae	2									
Orthocladius obumbratus	37									
Euorthocladius sp.	2									
Microtendipes caelum	2									
Diplocladius spp.	6									
Chironomid pupae	4									
Caecidotea spp.	14									
Empididae	2									
Antocha	1									
Total Individuals	100									
Total ~~Taxa~~ Genera	12									

HBI = 7.5

Duplicate – by Jon Stor

SUMMARY OF MACROINVERTEBRATE DATA

Site 4

STATION (LOCATION): Little Pipe Creek @ River Rd.

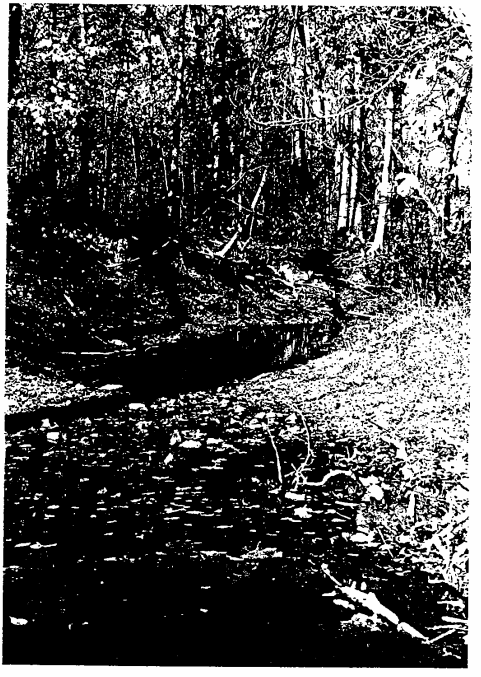
ORGANISM:	10/23/95 Date									
Stenonema tripunctatum	1									
Stenacron interpunctatum	6									
Cheumatopsyche spp.	23									
Ceratopsyche sparna	6									
Pycnopsyche sp.	1									
Stenelmis crenata adult	1									
larvae	1									
Empididae	1									
Orthocladius obumbratus	36									
Diplocladius spp.	8									
Thienemanny mia group	2									
Parametriocnemus lundbecki	2									
Simulium sp.	5									
Caecidotea sp.	7									
Total Individuals	100									
Total ~~Taxa~~ Genera	13									

HBI = 7.1

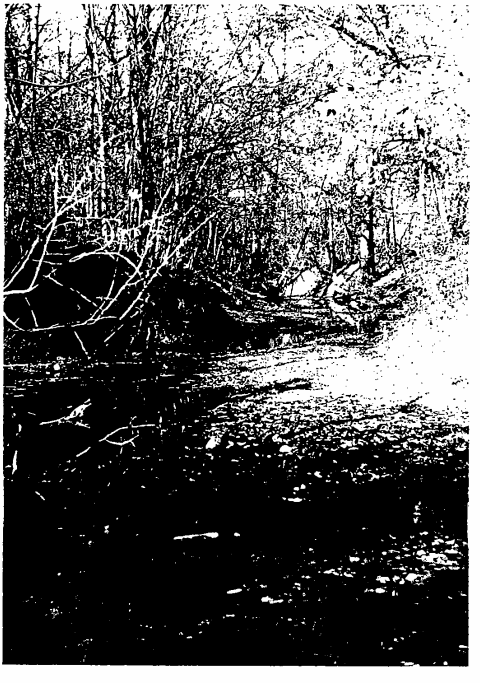
Twelve Mile Creek
Reference Stream
Site 1

Little Pipe Creek
Lower Watershed
Site 4

Little Pipe Creek
Site 4
Sampling in riffle



Little Pipe Creek
Upper Watershed
Site 2



Little Pipe Creek
Middle Watershed
Site 3